CUNY Graduate Conference

Schedule and Abstracts

The Graduate Center, CUNY
365 Fifth Avenue
New York, NY 10016
Science Center, Room 4102

Tuesday, May 1, 2012
9:30am till 4:30pm

9:30–10:00:	*Coffee*
10:00–10:25:	Maurice Lepouttre
10:30–10:55:	Jason Groob
11:00–11:25:	Andrew Hofstrand
11:30–11:55:	Kristen Zugibe
12:00–1:00:	*Lunch*
1:00–1:30:	Timothy Susse
1:40–2:10:	Sajjad Lakzian
2:20–2:50:	Viveca Erlandsson
3:00–3:30:	Aron Fischer
3:40–4:10:	Brent Cody

Morning Session:
Master Students from Hunter College

Maurice Lepouttre, Hunter College

Implementation of the Piecewise Collocation Method on an FEM-style Partition for a Parabolic PDE

Partly due to its ease of implementation and conceptual simplicity, the collocation method (CM) is a popular method for the solution of ordinary (odes) and partial differential equations (pdes). In implementing the method, decisions must be made regarding the choice of basis functions and the partitioning of the underlying domain. The most common approaches in the literature are global collocation and orthogonal spline collocation (OSC). Global collocation utilizes basis functions that are defined on the entire domain along with nodes derived from a Chebyshev partition. OSC uses piecewise defined basis functions and nodes derived from Gaussian quadrature points of subsets of the domain. In a previous paper, piecewise collocation was implemented for 2-dimensional elliptic pdes on a finite element method (FEM) style triangular partition. The method was shown to have convergence of order $O(h^2)$, where h is the length of the longest side of all triangles. CM was faster than FEM in both development and running time. In this paper, the method is extended by verifying the solution procedure for 1-dimensional pdes. In addition, the method is implemented on a parabolic pde, and is shown to provide comparable results to typical implementations of CM.

Jason Groob, Hunter College
Discontinuous Piecewise Polynomial Collocation In Three Dimensions

A collocation method based on a piecewise polynomial approach in three spatial dimensions will be used to find numeric solutions to the Laplace and Helmholtz equations (possibly other PDEs as well). The model is based on a finite element partition where the polynomial interpolation may be discontinuous across tetrahedral element boundaries. Results will be compared to numeric solutions from the finite element method to analyze both the accuracy and time-to-completion of the collocation method.

Andrew Hofstrand, Hunter College
Analogous Euler-Maclaurin Formulae for the Midpoint and 2-Point Gauss Methods of Integration

The Euler-Maclaurin Formula is a powerful and well-known result from classical numerical analysis relating discrete sums to integrals. One way to establish this equation is by utilizing periodic Bernoulli Polynomials which can be derived using a simple generating function. Using certain properties of these polynomials one can perform a straight-forward integration by parts to obtain the standard Euler-Maclaurin Formula which contains a relation involving the trapezoid rule for integration. This research focuses on establishing a generalized Euler-Maclaurin Formula for the midpoint and the 2-point Gauss numerical schemes. As the standard Euler-Maclaurin Formula contains the Bernoulli Numbers, the analogous midpoint and 2-point Gauss formulae generates an alternate sequence of coefficients. These new coefficients, in the case of the midpoint formula, can be recursively generated from the original Bernoulli Numbers, while the Gauss coefficients are derived from a generalized set of periodic piecewise polynomials initially discontinuous at the two Gauss points within each interval.

Kristen Zugibe, Hunter College

Using Numerical Root Finding Methods to Determine Points of Tangency

Consider a circle lying of specified radius rolling down a given curve that intersects with a second curve. When the circle comes to rest between the two curves and it determines two tangent points, one on each curve. My research determines the coordinates of the two tangent points and the center of the circle as determined by the circle radius. My solution rests on a bisection technique.

Afternoon Session:
Ph.D. Students at Graduate Center

Timothy Susse, Graduate Center
Quasihomomorphisms and Stable Commutator Length

A quasihomomorphism on a group is a function with image in the real numbers that misses preserving multiplication by a uniformly bounded amount. The set of all quasihomomorphisms on a group forms a vector space over the reals, and in many interesting cases it is either trivial or infinite dimensional. We will discuss quasihomomorphisms and present examples, as well as talk about strong connections to the theory of stable commutator length. Time permitting, we will discuss recent work by the speaker and others regarding computations of stable commutator lengths in specific types of groups.

Sajjad Lakzian, Graduate Center
Smooth convergence away from singular sets

Given two Riemannian manifolds, the distance between them can be measured using the Lipschitz, Gromov-Hausdorff and Intrinsic Flat distances. We will present new approaches to estimating these distances given information on subdomains in the manifolds. Then we will apply these results to understand the Gromov-Hausdorff and Intrinsic Flat limits of sequences of Riemannian manifolds which converge smoothly away from singular sets.

Viveca Erlandsson, Graduate Center
The Margulis region and screw parabolic elements of bounded type

Given a discrete subgroup of the isometries of n-dimensional hyperbolic space there is always a region kept precisely invariant under the stabilizer of a parabolic fixed point, called the Margulis region. While in dimensions 2 and 3 this region is always a horoball, in higher dimensions it has a more complicated shape. This is due to the existence of parabolic elements with a rotational part, called screw parabolic, in dimensions 4 and greater (in lower dimensions any parabolic element is conjugate to a translation). In this talk we discuss the course shape of the Margulis region in hyperbolic 4-space corresponding to a screw parabolic whose angle of rotation is irrational of bounded type. We describe the asymptotic behavior of this region and show that it is quasi-isometric to a horoball.

Aron Fischer, Graduate Center
Of Twisting functions, Twisting Cochains and the free loop space

Brent Cody, Graduate Center
TBA

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